Crystallographic Analysis of Zinc Oxide Nanocrystals via Scanning Electron Nano Diffraction (SEND)

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Over the past decade the interest of zinc oxide nanomaterials has increased drastically. ZnO is a hexagonal structure in wurtzite with $P6_3mc$ symmetry and known as material for various intrinsic point defects. While the growth of ZnO nanocrystals in liquid phase is well-studied [1-5], Ali and Winterer published a long-term study about the growth in powder form and at room temperature [6]. It is pointed out that the growth mechanism is different from liquid phase.

However, in order to understand the growth mechanism it is enlightening to monitor the structural change of the ZnO nanocrystals. Within the present study we demonstrate that *Scanning Electron Nano Diffraction* (SEND) [7] in a STEM is a suitable technique to fulfill the requirements. The ZnO nanocrystals were synthesized via chemical vapor synthesis (CVS) [8] and investigated in a FEI Titan S/TEM @ 300 kV [9]. SEND is the nano scaled answer to the SAED technique and operates with a nearly parallel electron probe of 2 nm size which produces 100 diffraction patterns each measuring campaign.

As result we presented in pole figures that within a few weeks the ZnO nancrystals are tending to grow in rod-like structures which fits also with observations made by Pacholski *et al.* [10]. The growth mechanism is given by annealing the crystal defects which was suggested by Ali and Winterer.

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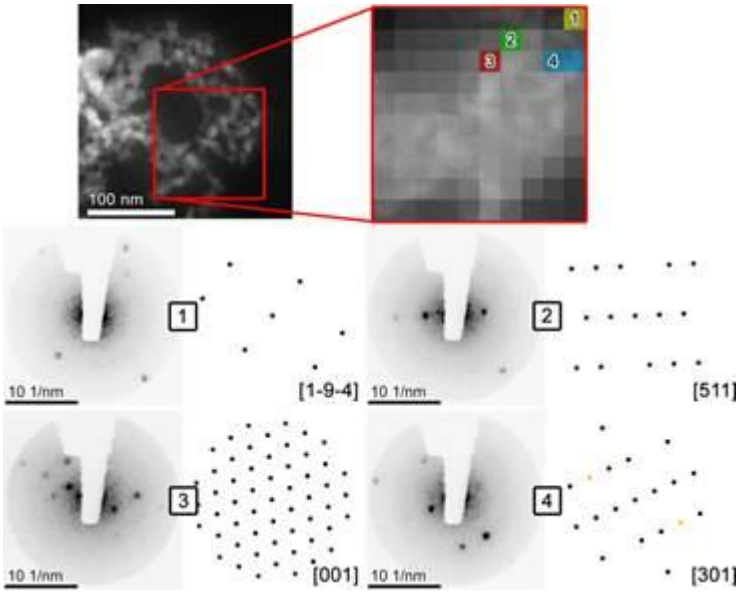

Figure 1: Scanning Electron Nano Diffraction (SEND) patterns and their corresponding simulated electron diffraction patterns for zinc oxide nanocrystals at t = 43 d.

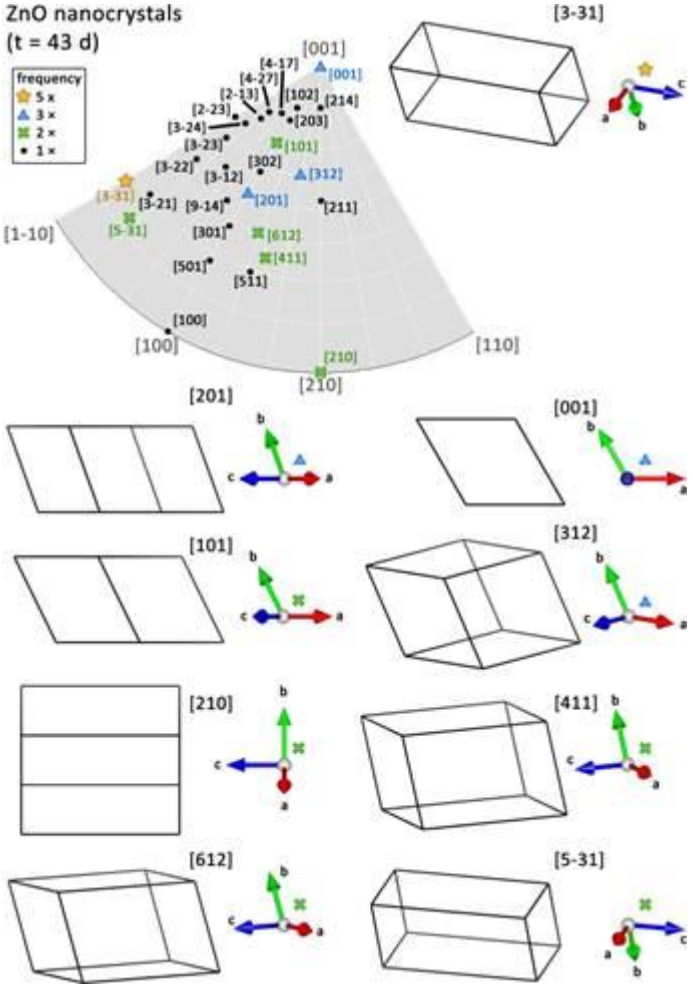

Figure 2: Pole figure of zinc oxide nanocrystals stored at room temperature at t = 43 d.